THE Q.E.A. DH86 RADIO EQUIPMENT.

Each of the five DH86 aircraft, VH-USC, VH-USD, VH-USE, VH-USF and VH-UUA (which replaced the lost VH-USG during delivery by Imperial Airways), was fitted with almost identical radio equipment. For all practical purposes the equipment, component by component, could be exchanged between aircraft. It was Marconi equipment.

Basically the equipment consisted of the following:

1. A multi-purpose high frequency/low frequency transmitter. It was not crystal controlled but operated on the M.O.P.A. principle. The high frequency (short wave) section could be 'tuned' to any desired frequency between about 4 megacycles and 8.5 megacycles. We normally transmitted, when using high frequency, on about 6540 kilocycles. (Note: This frequency was later adopted by D.C.A. as a common high frequency throughout Australia and Papua-New Guinea. It was guarded by all D.C.A. aeradio stations for about 25 years and was carried in all Australian registered and radio-equipped aircraft. This frequency, when it became overloaded, was relegated to a regional frequency but is still used to great advantage in this capacity. Q.E.A. used this 6540 kilocycles from the inception of DH86s because it was considered within Q.E.A. to be an outstandingly suitable frequency for the purpose and over the distances involved.)

The low frequency (now more correctly known as medium frequency) section could be tuned to any desired frequency between about 280 kilocycles and 600 kilocycles. We normally transmitted on about 333 kilocycles for communication with such aeronautical stations as then existed, or on 500 kilocycles for communication with Coastal Radio Stations and ships at sea.

Transmissions were made on either straight continuous wave (C.W.), or on interrupted continuous wave (I.C.W.) (Note: This was not modulated continuous wave (M.C.W.) as would normally be used today). Voice transmission, excepting for a few preliminary tests which proved the facility in this type of equipment to be almost useless and in any event of no real practical value, was not used. All communication was by means of the morse code using almost entirely the long-established marine (ships at sea) practices and procedures.

Power for the transmitter (and for the receivers, aircraft lighting, and engine starters) was derived from a battery similar to that used in a motor car, and charged in flight by a wind-driven generator positioned at the leading edge of the port-side upper wing.

Excepting for relatively close-in working when a "fixed" aerial was used, transmissions were mainly effected via a "trailing" aerial. A hand winch (incidentally very inconveniently located) was used to let out or wind in about 200 feet of stranded copper aerial wire with beaded lead weights at the distant end.

2. A multi-purpose high frequency/medium frequency receiver. As in the case of the transmitter, the receiver was not crystal controlled. However, although the receiver when being used on high frequency in particular did "drift" somewhat, it was a remarkably reliable and efficient receiver. It could be tuned, in two bands, which approximated those available in the transmitter.

The DH86s were neither screened nor (during the very early days) fully bonded. As a result of this deficiency, ignition induction from eight magnetos made reception on high frequency almost impossible and in any event quite unreliable in the air. On the ground, with the motors off, reception was excellent and on two occasions in particular I used high frequency on the ground to considerable advantage. Once was to work with Singapore from Batavia on the occasion of the delay that brought about the "Lost and found" episode. The second important occasion was at Waingapoe when, having blown a tyre, we were able to communicate direct with Darwin and arrange for the quick delivery of a replacement.

Reception on medium frequency, on the other hand, was normally quite effective and some surprising distances were covered, particularly on 333 kilocycles. Atmospheric disturbances, particularly during the northwest monsoon seasons were often troublesome.

In general terms it can be said that we transmitted on 6540 kilocycles and received on 333 (or as circumstances required) on 500 kilocycles.

3. A Direction Finding attachment. Today's A.D.F. (automatic direction finding) equipment in aircraft consists basically of a small rotatable 'loop', an independent receiver, a meter calibrated as is a magmetic compass, and a pair of headphones. Recognising deficiencies that are encountered when using medium frequencies on any type of direction finding equipment, (so-called 'night' effect and others) the present airborne A.D.F. has considerable uses. This was far from the case with the DH86 equipment. In the first the 'loop' was not by itself rotatable. The wire forming ~~the loop was~~ wound round the inside of the back freight locker. The only possible means of 'rotating' the loop was to rotate the aircraft. In a dire emergency this might have been acceptable proposition. However, any thought of normally swinging the nose of an aircraft to and fro over possible 90°, particularly with passengers aboard, was quite unacceptable. Apart from this disability which was pronounced in itself, there was no independent receiver nor was there anything approaching reliability in the 'sensing' facilities. For practical purposes it was impossible, even were some form of bearing obtained, to determine whether the signals were coming from ahead or astern. I experimented with a loop in the nose locker with slightly better but still unacceptable results. I heard that Imperial Airways were having good results with this type of DF equipment in their AW 15 aircraft west of Singapore. I made two voluntary runs between Singapore and Alor Star with Imperials but I could not be convinced that their DF results were better than ours. In fact the swinging to and fro of an AW 15 was a major operation, slow and tedious, and to my way of thinking totally unacceptable for a passenger-carrying aircraft. After about a year of seriously trying to make the DF on the DH86s work satisfactorily, we gave it away and dismantled the 'loop' in the back locker where it was a hinderance when loading baggage and cargo.

I now turn for a few minutes to the actual use of the equipment discussed above.

During each flight from Brisbane to Singapore and return, we transmitted half-hourly position reports. While there was one service a week the transmission times were at 18 and 48 minutes past each hour. When the second weekly service commenced, that service took on 03 and 33 minutes past the hour as its scheduled reporting times. We gave our known or D/R position plus an E.T.A. or amended E.T.A. as appropriate. While there was no levity in our communications there were occasionally exchanges of a personal or semi-personal nature. I recall that when the Camooweal Postmaster (Harold Stiff, and a personal friend) became a part of the 'system' in 1935, I had but to add to our position report, the letters "F.W.S." (my initials) to be sure that the Rylie's would have ready for me a plate of sausages and eggs ~~when we landed~~ for breakfast.

Usually someone along the track would receive our report be it the Coastal Radio Station at Brisbane, Darwin, Soeraoaya or Batavia; the aeronautical station at Palembang; the R.A.F. station at Singapore, or a radio amateur such as Eddie (brother of Q.E.A. Neville) Hagarty at Iongreach, or perhaps Don Shearer anenthusiastic School Teacher at Quomby near Cloncurry. I always carried with me a home-made portable receiver specially adapted to receive Q.E.A. aircraft transmissions. At Darwin I was usually able to hear the aircraft throughout most of the flights Brisbane to Singapore and return. At Brisbane and Singapore I could usually hear them when they were within the nearer half of the flight. There were few, and widely spaced, ground stations capable of responding to the aircraft transmissions and in any event, quite often, transmissions were not heard by anyone, but only because nobody was listening.

The weakest links in the communication chain were between Roma and Daly Waters wherein no ground station, supposing the aircraft transmissions had been heard, were capable of transmitting on the aircraft frequencies, and between Rambang (Lombok Island) and the Sumatra coastline north of Batavia. In this latter area we were required to take our place with ships at sea and 'fight' for attention from the Soerabaya and Batavia Coastal Radio Stations. I would demonstrate this unsatisfactory state of affairs by the following short story. On one occasion that I clearly recall, I asked Soerabaya for a local weather report. We were then aoout 150 miles east of Soerabaya. We finally received the weather report at a position about 150 miles WEST of Soerabaya. In the meantime we had landed at Soerabaya, exchanged mails, refuelled and proceeded on our way.

The standard of aeronautical communications on the Brisoane to Singapore route, particularly during 1935 and 1936, was of a very low order. The real weakness lay in the fact that, apart from Palembang in Sumartra, there was not one reasonably equipped aeronautical communication station. The DH86 equipment, accepting certain inadequate elements by today's standards, was itself quite good. Given sufficient adequately equipped ground stations along the Brisbane to Singapore route we should never have been out of communication with the ground. The airborne equipment which was of Marconi origin was remarkably reliable, robust, and in the hands of qualified radio operators extremely efficient. There were occasions, however, when we could have called our heads off; we could have been "in the drink", or we could have been "down" in the tiger country between Cloncurry and Mt Isa, or around Lombok and Bali, and nobody would have known that anything was amiss until we failed to arrive somewhere. Fortunately we always did arrive but this was due to other factors. There was the high standard of aircraft maintenance; strict butfair discipline; responsible supervision, and (although I had the honor to be one oi them) an outstanding set of crew members who pulled well together,and overall Management that "saw fair play".

THE Q.E.A. DH86 WIRELESS EQUIPMENT

I cannot at this stage provide details of type and serial numbers. If these are required some research will be necessary. In the meantime I shall give a short running commentry on the equipment and touch upon its uses.

There were two receivers and one transmitter. Neither the receivers nor the transmitter were "crystal controlled". The transmitter was of the type known then as M.O.P.A. (master oscillator power amplifier). It could be used on straight C.W. (continuous wave), I.C.W. (interrupted continuous wave), or on voice. For several reasons that I shall not go into here, the voice transmissions were not satisfactory and, apart from some initial testing, were not used. Morse was the main means of communication.

The transmitter was capable of being 'tuned' over a fairly wide range in two steps. On the high frequency side the coverage was from somewhere about 4 megacycles up to about 8.5 megacycles. The frequency in use could not (due to certain inadequacies in the equipment,)be precisely set nor having set the frequency could one be sure that, when next the transmitter was switched on, the same frequency would be available. Normally, on the high frequency side, we used something around 6540 kilocycles which proved to be a most satisfactory frequency for the purpose. Indeed when I later went to D.C.A. I was instramental in having 6540 kilocycles retained throughout Australia as the "emergency" frequency which was guarded by every aeradio station,which procedure still applied when I retired from D.C.A. in 1963. On the low frequency side the frequency coverage extended from somewhere about 280 kilocycles to something around 600 kilocycles. We used 333 kcs for D/F when such ground facilities were available and for communication with ground stations (except Sourabaya and Batavia of which more later) when high frequency was not suitable or not necessary. We also used it from time to time to "natter" between Q.E.A. aircraft when passing each other en-route. We used 500 kcs (now a maritime distress and calling frequency) for occasional communication with ships at sea. I had a friend who was Wireless Operator at that time on the s.s. "Marella", a B.P. steamer that traded between Melbourne and Singapore via the East coast. Whenever "Marella" was in the area anywhere between Brisbane and Singapore I could be sure of making wireless contact with that ship. 500 kcs was also used for communication with the Coatal Radio Stations at Sourabaya and Batavia. There was then no other station in Java with whom we could communicate. Working on 500 kcs, however, had its problems as we were forced to "fight" for a place on the air against many ships at sea and all wanting priority, and most of the ships having a transmitter power far in excess of ours - a ratio of something around 30 to 1.

On the receiving side, one receiver covered both high frequency and medium frequency. We could receive, by tuning the receiver, either 333 kcs or 500 kcs. High frequency, however, was seldom used for reception simply because, due to a lack of bonding and ignition screening in the aircraft, 'noise level' in the headphones was too high in comparison with signal level. There were occasions, however, when it would work but usually this was when it was least needed.Occasionally I would tune in to an amateur band and contact an enthusiastic amateur probably thousands of miles away from me. Once I recall, when flying between Mt Isa and Camooweal during the early hours of one morning, establishing good high frequency communication with another friend who happened to be a lightkeeper at Gabo Island - Bob Jordan by name.

The second receiver was provided as a part of the aircraft's D/F facilities. As a receiver it was very good when used with the aircraft's normal trailing aerial. The weakness in the D/F facilities aboard the aircraft rested squarely on the type of D/F "loop" installed. Now, in these enlightened times and over the past few years, the aircraft "loop" aerialis compact, easily rotated and adequately designed. Our "loop" was not like the

modern version. It consisted of about 20 turns of stranded, rubber-insulated wire would on formers around the inside of the after freight locker. There was no means by which the loop could be rotated other than to rotate (swing the nose to and from over about 90°) and hope to get a bearing. In additionthe wire that formed the loop somehow could not be kept rigid and as a result it bounced about in turbulance. I made a strenuous effort to get bearings on this equipment but, for one thing, few Captains were prepared to swing the aircraft to and fro as I have just outlined. If there were passengers this was a most disconcerting procedure. I heard that Imperial Airways were having some success with this type of equipment in their AW 15 type aircraft so I made two voluntary runs with them between Singapore and Alor Star to see for myself. Provided the aircraft was swung rather violently to and fro, there was a little better result in the AW 15 but still far from good. We eventually took the so-called loop out of the DH86's and used the receiver only as a stand-by to the normal MF (medium frequency) receiver. In the meantime I had tried an experimental loop in the front freight locker but, while it proved a little better than the loop in the back locker, the need to swing the aircraft to and fro made it a completely unsatisfactory arrangement.

On the actual operating side, as I said earlier, morse was the essential means of communication. Each of the First Officers, and at least one Captain at that time, held a First Class Wireless Licence. A lack of ground stations was our real problem particularly and strangely within Australia. When the Q.E.A. service to Singapore commenced operation, the following ground radio facilities were available;

Brisbane. The Coastal Radio Station opened a listening watch on 6540 kcs for 3 minutes each half hour during the first day's flight (Brisbane to Cloncurry). We transmitted a position report each half hour. Between Brisbane and about Roma we could work two-way with Brisbane but after Roma we could not receive due distance. During the second day flight (Cloncurry to Darwin) we again transmitted a report each half hour which Darwin Coastal Radio Station copied. Upon reaching the vicinity of Birdum we again were able to work two-way, this time with Darwin. On the two days flight from Darwin to Singapore we sent a position report each half hour as we did while crossing Australia. Between Darwin and Koepang, Darwin kept a continuous watch and, usually (being over water) we were able to maintain two-way contact until landing Koepang. Koepang itself had a makeshift transmitter/receiver which provided some sort of a service while we flew between Koepang and Rambang. I, personally however, encouraged both Darwin and Broome Coastal Radio stations to watch for us over this section and seldom missed making a contact with one or the other of those two stations. From departure Rambang to a position some 100 miles or so beyond Batavia we were required to fall back on the shipping frequencies as mentioned above. Once we were well past Batavia we could, normally, work Palembang WHICH WAS THE ONLY PROPERLY EQUIPPED AND MANNED AERONAUTICAL RADIO STATION BETWEEN BRISBANE AND SINGAPORE. Even Singapore itself was a R.A.F. station that gave us civilians a second-grade service if they had R.A.F. exercises under way. We held on to Palembang to the last possible moment and changed over to Singapore only for a last-minute weather report and to give a final E.T.A. These circumstances persisted for almost two years after which a much improved service (with added equipment) was provided by Darwinand, still later, by Brisbane. The unsatisfactory gap between Koepang and Palembang still existed when I left Q.E.A. after 3 years service and 72 crossings of the affected area. With the lack of really good radio services on the Brisbane-Singapore run I am amazed, when I look back, that never was an aircraft lost nor, as far as I know, a single person injured. Although I was one of them, the crews who flew that route did a really marvellous job with, admittedly, a marvellously reliable aircraft maintained by a dedicated ground crew. In retrospect I am indeed proud to have been associated with the birth of Q.E.A.

Palembang, the next radio station on the route, if the operator had been advised of our movements, was an oasis in the desert. He was equipped with a good set of equipment including direction finding facilities and once alerted, kept a good watch and set a high standard of operating efficiency. Whether or not we went into Palembang for fuel or by-passed the placed on a direct track for Singapore, the operators at Palembang were always (in my experience) helpful in all respects. The final station was at Singapore which was operated by the R.A.F. Normally he gave reasonaole service but this standard fell off when there were R.A.F. exercises in the area. A shortage of trained radio personnel was usually given as a reason for this falling off of standard.

In addition to the official stations mentioned above, I always carried with me a home-made portable receiver and spent many hours watching the progress of Q.E.A. aircraft. At Singapore I could normally start to receive the aircraft after departure westbound from Koepang and hold the aircraft eastbound to about Rambang. At Darwin I could normally hear the aircraft, although not always copy all details due to weak signals, almost anywhere between Brisbane and Singapore. It might reasonably be asked why, if I could do this, could recognised stations do likewise? There are several reasons perhaps the main being that I, as the senior Q.E.A. radio man, had a keen interest in proceedings. I would 'struggle' to hear and if possible read signals that would often be passed over as useless by the operator (particularly those outside Australia) that had no more than a bread and butter interest.

By present-day standards, Q.E.A. during the DH86 operations, were often "out of communication" and, if the present-day S.A.R. alerting service been operating, too often would DH86s been "overdue". The DH86s, even with their radio weaknesses in some respects, were fully capable of maintaining two-way communication

I would turn now, for a few minutes, to the actual use of the equipment discussed above.

Throughout each flight Brisbane to Singapore and return, we transmitted half-hourly position reports on 6540 kilocycles. Someone usually heard these reports either the Brisbane Coastal Radio Station, an amateur radio operator at Longreach by name Eddie Hagarty(and a brother of Nevil a Q.E.A. engineer), the Radio Postmaster at Camooweal, the Coastal Radio Station at Darwin, a part-time station at Koepang, the Coastal Radio Stationsat Soerabaya or Batavia, the aeronautical (and only one on the route) station at Palembang, or the R.A.F. station at Singapore.. Over some of the route, however, we could not obtain acknowledgements for these reports. We could normally receive Brisbane on 333 kilocycles as far as Roma. During the first year or so and until the postmaster at Camooweal was authorised to communicate with us, our next two-way contact would be with Darwin from a position near Birdum. We were able, normally, to maintain two-way contact with Darwin from departure there until landing Koepang. Between Koepang and Soerabaya via Rambang there was some 'hit and miss'. Broome Coastal Radio Station, although not a recognised station in the scheme could often be contacted after applying a little communication 'nouse'. Soerabaya and Batavia, although authorised stations, treated us on equivalent terms with ships at sea. We took our turn. Our speed of around 135 knots meant nothing to the operators at Soerabaya and Batavia who were used to working with ships operating at speeds probably little higher than 10 or 12 knots. I recall asking Soerabaya for a local weather report while we were about 100 miles to the east, and receiving the report when we were about 100 miles to the west, having in the meantime landed, refuelled, and departed again.